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Prevalence of Amblyopia in Primary Schools Students at Nasiriyah City

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Abstract

Background. Amblyopia is common in children and is an important socioeconomic problem, particularly due to its impact on patients' personal, educational and professional lives, there is a variation in the prevalence of amblyopia at both national and international levels.

Purpose. To assess the prevalence and possible risk factors of amblyopia among Primary Schools children at Nasiriyah city.

Methods. A cross-sectional study carried out during the period from March 2022 to June 2023 at the first and second semesters of the school years 2022 and 2023 at the primary schools of Nasiriyah city. Eight governmental primary schools (4 for boys and 4 for girls) were randomly selected and 480 children were randomly recruited from all school grades and classes of these schools. Official agreements obtained from local authorities and Signed consents obtained from children's' parents or guards. Data collected through full history and through ophthalmological examination conducted by specialist ophthalmologist with assistance of professional individuals and teachers.

Results. A total of 480 primary school children were included. The age of students ranged between 6 and 14 years with a median of 9 years. Males and females were equally present in the study. Prevalence of amblyopia was 4.38%. Hypermetropia, myopia and stigmatism reported in 5.2%, 4% and 2.7% of the studied group, respectively. Abnormal visual acuity was present in 32.5% of children. Family history of amblyopia, wearing spectacles, refractive errors and abnormal visual acuity were the significant risk factor of amblyopia (P. value <0.05).

Conclusions. The prevalence of amblyopia among primary schools' children in Nasiriyah city was 4.38%. The main risk factors or causes of amblyopia found to be family history of amblyopia, wearing spectacles, refractive abnormalities; and abnormal visual acuity.

Keywords: amblyopia, etiology, epidemiology, risk factors, primary school children

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Распространенность амблиопии среди учащихся начальных школ города Насирия

Конфликт интересов: не заявлен.

Вклад авторов: Джааз М.Х. – идея, методология, формальный анализ, исследование, ресурсы, обработка данных, написание оригинального текста, редактирование окончательной версии; Сачит И.Х. – контроль, идея, методология, ресурсы, курирование данных, написание оригинального текста; Фахад А.А. – контроль, идея, ресурсы, курирование данных, написание оригинального текста.

Этическое разрешение. Все этические вопросы были одобрены авторами. Официальное согласие получено от местных властей. Подписанное информированное согласие было дано родителями или опекунами детей до участия в исследовании, а сбор данных соответствовал Хельсинкской декларации Всемирной медицинской ассоциации «Этические принципы медицинских исследований с участием людей».

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Резюме

Введение. Амблиопия часто встречается у детей и является важной социально-экономической проблемой, особенно из-за ее влияния на личную, образовательную и профессиональную жизнь пациентов. Распространенность амблиопии варьируется как на национальном, так и на международном уровне.

Цель. Оценить распространенность и возможные факторы риска амблиопии среди детей начальных школ города Насирия.

Материалы и методы. Перекрестное исследование проведено в период с марта 2022 г. по июнь 2023 г. в первом и втором семестрах 2022 и 2023 учебных годов в начальных школах города Насирия. Восемь государственных начальных школ (4 для мальчиков и 4 для девочек) были случайным образом выбраны, и в таком же случайном порядке было набрано 480 детей из всех классов этих школ. Официальные согласия получены от местных органов власти, подписаны согласия от родителей или опекунов детей. Данные собраны на основе всей истории болезни и посредством офтальмологического обследования, проведенного специалистом-офтальмологом при содействии профессиональных специалистов и преподавателей.

Результаты. Всего в исследование были включены 480 детей обоих полов начальной школы. Возраст колебался от 6 до 14 лет, в среднем – 9 лет. Распространенность амблиопии составила 4,38%. Гиперметропия, близорукость и стигматизм наблюдались у 5,2%, 4% и 2,7% исследуемой группы соответственно. Нарушение остроты зрения имело у 32,5% детей. Семейный анамнез (амблиопия), ношение очков, нарушения рефракции и аномальная острота зрения были значимым фактором риска развития амблиопии ($P < 0,05$).

Выводы. Распространенность амблиопии среди учащихся начальных школ города Насирия составила 4,38%. Основными факторами риска или причинами амблиопии



признаны семейный анамнез (амблиопия), ношение очков, аномалии рефракции и аномальная острота зрения.

Ключевые слова: амблиопия, этиология, эпидемиология, факторы риска, дети младшего школьного возраста

■ INTRODUCTION

Amblyopia in children is a significant health problem worldwide. Alterations in the visual development stage in children and amblyopia have adverse consequences in the life of children and have shown to be associated with poor education, skills, cognitive and school readiness performance [1, 2]. It also affects the health and well-being outcomes in the next adult life of amblyopic children [3]. These issues need more efficient efforts to increase the awareness among parents, healthcare providers and education centers [4]. Amblyopia, among the main causes of visual morbidity and bilateral impairment preceded only by refractive errors and keratitis, and even more than ocular trauma [5]. Clinically, amblyopia is a sensorineural alteration, which is defined as a reduction in visual acuity, which can be unilateral, or bilateral, due to binocular interaction during the visual development period, which cannot be attributed to an anatomical defect of the eye, an alteration of the visual system or refractive errors and that it is generated by an abnormal visual experience at an early age. According to the American Academy of Ophthalmology, amblyopia is considered as an intra-ocular variation in the visual acuity (VA) table of two lines or more or a VA of 20/30 or less [6].

The causes of amblyopia are uncorrected refractive errors [7], strabismus and anisometropia which are almost equal in prevalence, however, these are responsible for majority of causes [8].

This anomaly is considered of public health interest due to the negative impact it has, not only for the people who suffer from it, but also for the family and society in general, due to the difficulties in carrying out activities of daily life, such as school, social and even emotional development of individuals; in addition to generating costs [9, 10].

The study of amblyopia has been based mainly on the biological aspect, and this is fundamental for the understanding of the natural history of the disease; however, it does not allow a full understanding of the dynamics of the binocular vision abnormality. It was found that in addition to the specific factors in the visual conditions, such as hyperopia, astigmatism, anisometropia, esotropia, exotropia, and family history of amblyopia there are others factors that favor the development of amblyopia, among which are the socio-economic, origin race, antecedents as pre-term delivery, general antecedents of the parents and of the same individuals, as well as the possibility of access to health services [11].

The prevalence of amblyopia worldwide is 2.6 to 7 percent. However, the prevalence differs according to the age, classification and place, for instance the higher prevalence in America while the lowest in Africa [12]. In Arab countries, the prevalence of amblyopia ranged between 1.3–3.9% in Saudi Arabia, in Jordan the prevalence of amblyopia in first and second grades children aged 6 and 7 years was 2.78% [13], in Egypt it was 1.98% [14]. In other countries like Iran and Turkey, prevalence of amblyopia ranged between 0.19% to 3.6% [15, 16].

In Iraq the situation is not much different than other countries, however, at the national levels, there is some variation in the prevalence of amblyopia among school children in different Iraqi provinces; studies conducted in different Iraqi governorates reported a rate between 1.8% to 4.8% [17, 18].

However, amblyopia still under reported despite the availability of diagnostic methods and it is well-known that it is possible to treat amblyopia and restore normal visual acuity in children if the condition is diagnosed and treatment is applied at an early age, hence, it is important for every child (whether has symptoms or not, and whether has previous cases in his family or not) to be examined by an ophthalmologist. The diagnosis of amblyopia is usually obtained by a complete ophthalmological examination, obviously observing a decrease in visual acuity, and it is also possible to identify, in the vast majority of cases, the underlying cause [19].

Subsequent examinations depend on what will be diagnosed in the first examination. The early detection of amblyopia has significant impact on the effectiveness of treatment and outcomes [20, 21]; therefore, screening for amblyopia among pre-primary and primary school children is adopted and conducted in many countries [14, 22–24].

The treatment of amblyopia is usually directed according to the etiology, as well as the age at the time of diagnosis. Traditionally, the treatment involves penalizing the non-amblyopic eye either by the occlusive method or by the pharmacological method, using atropine, with high success rates. Treatment of amblyopia depend mainly on the cause to correct it; a refractive defect, must be corrected through glasses or contact lenses; or if there is a visual obstruction, such as a cataract (which can be operated on), a drooping eyelid that covers the pupil (its height corrected by surgical intervention), it must be removed. After determining the cause, the treatment of is started. The procedure that has been found to be the most effective so far is to cover the healthy eye with a patch. The time and timing of eye coverage depends on the extent and cause of the amblyopia, and on the age of the child. It is extremely important to emphasize that the effectiveness of current treatments depends on their implementation during a critical period, which differs depending on the cause of amblyopia, being related to the maturity of the visual pathways; the duration of visual deprivation and the age at which it is instituted, losing its effectiveness at 5/6 years of age. In cases of failure or non-performance of treatment, this can become irreversible, persisting throughout the patient's life and associated with high morbidity, especially if combined with other ophthalmological pathologies that affect the healthy eye [25–27]. In Iraq, the specific frequency for the population has not well established, making it difficult to create programs and interventions aimed at solving the real needs of the population, as well as the ignorance of visual disturbances, as factors that affect the quality of life of children and their families.

Thus, early detection is an ideal goal that we should aim to achieve, in order to start treatment at a time when it can be effective. This is why the objective of this study is to determine the prevalence of amblyopia in the school children of Nasiriyah city.

■ METHODS

This was cross-sectional study carried out during the period from March 2022 to June 2023 at the first and second semesters of the school years 2022 and 2023 at the primary schools of Nasiriyah city.



Data collected comes from the primary school population, pupils at or older than 6 years, belonging to primary public schools, located in the urban area of the municipality of Nasiriyah, Thi-Qar governorate, south of Iraq. In this population, the prevalence of amblyopia was established through complete visual assessments.

Inclusion criteria

Primary schools' students at the public (governmental) primary schools in Nasiriyah city of both genders, who were attending the school semesters for the years 2022–2023. All students were enrolled in the study after an agreement of their parents/guards, where an informed letter had been sent to parents/guards to agree for participation of their children in the study with an explanation for the nature and objective of the study.

Exclusion criteria

1. Students whose parents/guard refused the participation of their children in the study.
2. Students who could not perform all the tests during examination to reach the diagnosis.
3. Students who refused the examination.
4. Students with decreased visual acuity secondary to anterior and posterior segment pathologies, detected by ophthalmologist.
5. Students with history of traumatic head and eye injury.

Sample size calculation and sampling technique:

The required sample size for the study was calculated using the standard equation for cross-sectional studies [28, 29] as followed:

$$N = \frac{Z^2 * PQ}{d^2},$$

where N is sample size

Z: is the standard normal variate at 5% type I error ($P \leq 0.05$), the Z value = 1.96.

P: is the expected prevalence in the population based on earlier studies, however to get the larger sample size, "P" proposed to be 0.50. The Q value equal to (1-P).

The "d" referred to the absolute allowed error or precision, in medical studies it is set to 0.05. The level of confidence was 95%, with adjustment for finite population.

Application of the aforementioned equation and values the calculated sample was 384 students, an extra 20% of students was added to overcome the non-response to participation. Hence, the total sample was 461 students and it was approximated to 480, therefore, 480 students of 8 primary schools in Nasiriyah city were randomly selected from the total primary schools in Nasiriyah city. These schools included 4 schools of boys and 4 schools of girls. At each school level 60 students were selected from all school grades from first to sixth grade, where 10 students selected from each grade.

Data collection

Data collected using a pre-constructed data collection sheet (questionnaire) including three sections, the first section send to the families to be filled and sign the consent for participation and provide the required data including the demographic variables,

family history and medical history of the students. The second part included the general examination of the students, body weight, height, school grade, school achievement, education performance (assessed according to the student school Cards). Third section involved the ophthalmological examination, visual acuity and ophthalmoscopic examination. All examination and interviews with children were performed separately in an isolated room prepared by the school management staff with the assistance of biology teachers in the selected schools and school health staff in the Department of Public Health of Thi-Qar health directorate.

For the selection of the study participants, the database provided by Thi-Qar Directorate of Education was obtained as a sampling frame, which contained information such as: number of schools, number of classrooms, number of students per each school in 2022. The sample design corresponded to a complex two-stage and stratified sample according to the size of the schools. The first stage corresponded to the schools, which were grouped according to their size, and for this the quartiles were used; the second stage was the final classrooms or clusters.

The number of schools selected was 8, chosen randomly and with a representation by stratum proportional to its size. The secondary sampling units were the classrooms, selected through simple random sampling, and 10 students were randomly selected from each class, giving a total of 60 students from each school.

Statistical analysis

It was performed using the statistical package for social sciences (SPSS) version 26 and Microsoft Office, Excel software version 2019. The prevalence of amblyopia and percentages of the categorical variables, the inclusion probabilities and the adjustments were measured. The univariate analysis of categorical variables, frequency tables were made. For numerical variables calculated with the inter-quartile range. The bivariate analysis was carried out through cross-tabulation. The Chi Square test with a significance level of 5% was used to evaluate the relationship between the categorical variables.

■ RESULTS

A total of 480 students were enrolled in this study, they were equally distributed according to gender, 240 boys and 240 girls.

The age of students ranged between 6 and 14 years. The median age was 9 years (inter quartile range (IQR) for median was 6–12). Family income was adequate in 60.6% of families of children, the median crowding index was 2 and 282 children lived in houses with crowding index of 2 or more (i.e. crowded). Only 17 children had positive past medical history of chronic diseases, while 32 children had surgical history. Family history of amblyopia reported in 11% of the studied group, 28 children wearing spectacles and history of past eye complaint reported in 44 (9.2%) of children (Table 1).

According to the ophthalmological examination and assessment, amblyopia detected in 21 children giving a prevalence rate of 4.38% (Figure).

Refractive abnormalities and visual acuity assessment are shown in (Table 2) where 57 children had at least one refractive abnormality these included hypermetropia, myopia and astigmatism which were reported in 5.2%, 4% and 2.7%, respectively. Abnormal visual acuity detected in 156 children (32.5%).



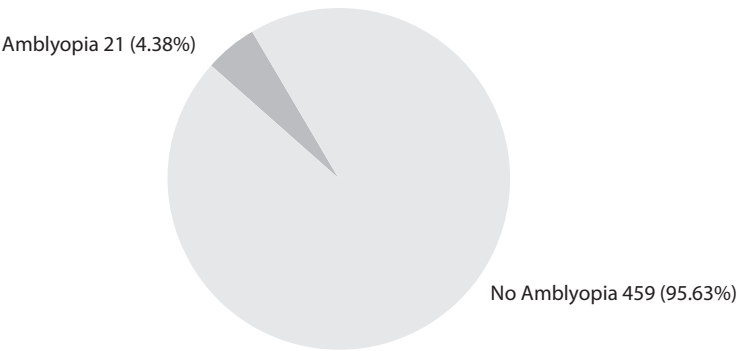
As shown in (Table 3), cross-tabulation between amblyopia and socio-demographic characteristics of the studied group revealed that amblyopia was relatively more frequent among young children, younger than 9 years, compared to older children, 4.7% vs. 4%, respectively, also amblyopia was more frequent in females than male children 5.8% vs. 2.9%, respectively, however, the relationship between amblyopia and each of age and gender did not reach statistical significance ($P>0.05$). Prevalence of amblyopia was not significantly associated with family income, crowding index, past medical history or past surgical history, in all comparisons, P value >0.05 . A significant association was found between amblyopia and positive family history of amblyopia which was more prevalent in children with positive than those with negative family history, 11.3% vs. 3.5% respectively ($P=0.024$). Amblyopia was significantly more prevalent in children wearing spectacles than those who did not; 17.9% and 3.5% respectively ($P=0.002$). Prevalence of amblyopia was higher in children with history of past eye complaint; however, the relationship was statistically insignificant ($P>0.05$).

A statistically significant relationship was found between refractive abnormalities and Amblyopia; where 28% of children with hypermetropia had amblyopia compared to 3.1% of children with no hypermetropia ($P<0.001$), higher prevalence of amblyopia, reported in myopic compared to non-myopic children (26.3%) vs. (3.5%), respectively ($P<0.001$), so as children with astigmatism had higher prevalence of amblyopia (23.1%), than those with no astigmatism (3.9%) ($P<0.001$), these findings demonstrated in (Table 4).

Abnormal visual acuity was significantly associated with higher prevalence of amblyopia where 9.6% of children who had abnormal visual acuity were amblyopic compared to only 1.6% of children with normal visual acuity ($P=0.002$) (Table 5).

Table 1
Socio-demographic characteristics of the studied groups

Variable	No.	%
Age (year)	≤9	253
	9–14	227
Median age (IQR)	9 (6–12)	–
Gender	Male	240
	Female	240
Family income	Adequate	291
	Not adequate	189
Crowding index	<2	198
	≥ 2	282
Past Medical history	Yes	17
	No	463
Past surgical history	Yes	32
	No	448
Family history of amblyopia	Yes	53
	No	427
Wearing spectacles	Yes	28
	No	452
History of past eye complaint	Yes	44
	No	436



The prevalence of amblyopia among the total studied group (N=480)

Table 2
Distribution of Refractive abnormalities and visual acuity

Variable		No.	%
Refractive errors	Hypermetropia	25	5.2
	Myopia	19	4.0
	Astigmatism	13	2.7
	None	423	88.1
Visual Acuity	Abnormal	156	32.5
	Normal	324	67.5

Table 3
The socio-demographic characteristics of the studied group

Variable		Amblyopia (n=21)		No Amblyopia (n=459)		P. value
		No.	%	No.	%	
Age	≤9	12	4.7	241	95.3	0.821
	9–14	9	4.0	218	96.0	
Gender	Male	7	2.9	233	97.1	0.112
	Female	14	5.8	226	94.2	
Family income	Adequate	13	4.5	278	95.5	0.889
	Not adequate	8	4.2	181	95.8	
Crowding index	<2	11	5.6	187	94.4	0.404
	≥2	10	3.5	272	96.5	
Past Medical history	Yes	1	5.9	16	94.1	0.768
	No	20	4.3	443	95.7	
Past surgical history	Yes	2	6.3	30	93.8	0.928
	No	19	4.2	429	95.8	
Family history of amblyopia	Yes	6	11.3	47	88.7	0.024
	No	15	3.5	412	96.5	
Wearing spectacles	Yes	5	17.9	23	82.1	0.002
	No	16	3.5	436	96.5	
History of past eye complaint	Yes	4	9.1	40	90.9	0.222
	No	17	3.9	419	96.1	

Table 4
Relationship between Amblyopia and refractive abnormalities

Variable		Amblyopia (n=21)		No Amblyopia (n=459)		Total	P. value
		No.	%	No.	%		
Hypermetropia	Yes	7	28.0	18	72.0	25	<0.001
	No	14	3.1	441	96.9	455	
Myopia	Yes	5	26.3	14	73.7	19	<0.001
	No	16	3.5	445	96.5	461	
Astigmatism	Yes	3	23.1	10	76.9	13	<0.001
	No	18	3.9	449	96.1	467	

Table 5
Relationship between Amblyopia and Visual Acuity

Variable		Amblyopia (n=21)		No Amblyopia (n=459)		Total	P. value
		No.	%	No.	%		
Visual Acuity	Abnormal	15	9.6	141	90.4	156	0.002
	Normal	6	1.9	318	98.1	324	

■ DISCUSSION

Amblyopia is common in children and is an important socioeconomic problem, particularly due to its impact on patients’ personal, educational and professional lives [1, 2, 9]. Many studies are carried out worldwide and revealed that the prevalence of amblyopia remained more or less unchanged over time despite the increase in early detection and diagnostic methods, on the other hand, there is a wide variation in the prevalence rate of amblyopia in different countries in a rate ranged 0.5–7.5% [30]. As It is difficult to assess the prevalence of amblyopia in the general population. Some studies dedicated to the epidemiological analysis of amblyopia have been carried out, but they tend to select specific populations, such as school and preschool children, ophthalmological patients [5, 11, 22]. In Iraq, the prevalence of amblyopia among Iraqi children varies at different provinces, however, in our province and specifically in Nasiriyah city, to best of our knowledge there is no study that included a large sample size of primary school children to assess the prevalence of amblyopia, hence we conducted this study to assess fill this gap in knowledge and further assessment of the possible risk factors contribute to amblyopia among school children population, hence, a total of 480 children were randomly selected from 8 primary schools in Nasiriyah city, examination and assessment were performed during the second school semester in 2022, the first and second semesters of the year 2023. We found that the prevalence of amblyopia among primary school children in Nasiriyah city was 4.38%, this reported rate was close to that reported by the Iraqi study of Hatow et al. that conducted in Amara city, south of Iraq [31] who found a prevalence rate of 4.8% among 768 children in primary schools of Amara. Other Iraqi study conducted in Diwaniya city reported a lower prevalence rate of 2.2% among school children [17]. Furthermore, Fayyadh et al assessed the prevalence of amblyopia among internally displaced school children in Fallujah, Ramadi, west of Iraq and found a prevalence of 1.8%, these findings indicated a variation in the prevalence of amblyopia across the national level.

Our reported rate was within the range reported in other countries in our region, in Saudi Arabia, Aldebasi Y. reported a prevalence rate of 3.9% among children aged 6-13 years at Qasim province [32]. In Jordan, a relatively lower rate was reported where Al-Salem et al. [13] reported a prevalence rate of 2.78% in Iran an overall prevalence rate of 3% was reported with a range of 1–5% [33]. In other countries, the prevalence ranged between 0.72% in Africa to 2.9% in Europe with a global range of 1–5% [30]. The variation in the prevalence rates was not unexpected due to the fact that prevalence of amblyopia could be affected by geographical variation, and nature of each population.

In our study we found other refractive abnormalities including hypermetropia, myopia and astigmatism which were detected among 5.2%, 4.0% and 2.7%, respectively, these rates were comparable to that reported in previous studies in Iraq and other countries [17, 18, 31].

Regarding the risk factors of amblyopia, we found that Family history of amblyopia, wearing spectacles, refractive abnormalities and abnormal visual acuity were significantly associated with higher prevalence of amblyopia, these findings agreed that reported in other studies [11, 13, 34, 35]. However, in our study neither age nor sex was significantly associated with the prevalence of amblyopia. The sex of the population evaluated has a similar percentage, showing differences are not statistically significant, which is equivalent to reports of studies related to visual disturbances in children population [36]. This is explained because both amblyopia and its etiological factors do not have a genetic relationship with sex.

In earlier study conducted in 2007, Donahue S stated that wearing spectacles by children put them at high risk of amblyopia [37]. Mocanu et al. [11] found that family history of amblyopia is a significant risk factor in children.

The present study evaluated clinical risk factors such as refractive errors, their severity; Socioeconomic variables, which have a positive association for amblyopia, which demonstrate the importance of a comprehensive visual and ocular assessment, not only considering clinical data, but also factors such as social determinants, which permeate any health condition of patients.

The strengths of this study were that the evaluations were completed by ophthalmologist, which allowed for an accurate diagnosis, supported by a group of professionals who, offered consultations and treatments if required. Due to the sample design, it was guaranteed that within the sample there was representativeness of the city's schools.

■ CONCLUSIONS

The prevalence of amblyopia among primary schools' children in Nasiriyah city was 4.38%. The main risk factors or causes of amblyopia found to be family history of amblyopia, wearing spectacles, refractive abnormalities; hypermetropia, myopia and stigmatism and abnormal visual acuity. Prevalence of amblyopia was not significantly affected by age, sex, and other demographic characteristics of the studied group. We recommend an efficient supported screening among primary school children and further large-scale studies for further assessment of prevalence rate in our province and the national level.



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